

## Reliable Thermodynamic Property Modeling for Gaseous HFC Refrigerants

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Many high-quality measurements on the thermodynamic properties of hydrofluorocarbons (HFCs) have led to the development of wide-ranging and precise thermodynamic equations of state. By comparing these wide-ranging thermodynamic equations of state developed for HFCs, we can find there are large discrepancies in the derived thermodynamic property values in the gaseous phase at lower temperatures and in the region near the saturation. The greatest differences are in the behaviors of heat capacities calculated from these equations of state near the saturation line. The calculated values for the specific heat capacities of the saturated vapor are sometimes different by 6 % in the case of HFC refrigerants. We will clearly show the differences in the curvatures of constant pressure lines regarding the heat capacities at constant pressure and at constant volume.

The temperature derivatives of the second and third virial coefficients affect the specific heat values very much at low temperatures and in the region near the saturation. The contributions of the temperature derivatives of the third virial coefficient to the specific heat capacities are different among the equations of state. The temperature function of the third virial coefficient is not always accurately determined from the existing measurements in connection with that of the second virial coefficient.

It is important to determine reliable thermodynamic property values not only for the field of refrigeration engineering but also for the academic fields such as developing reliable equations of state. Regarding R-32, R-125, R-134a, and R-143a, we have discussed virial equations of state that can represent the rational behavior of the heat capacities from a physical viewpoint based not only on highly accurate thermodynamic property measurements but also on a theoretical background such as the Stockmayer potential.